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ABSTRACT

This paper examines the biophilia hypothesis put forth by E. O. Wilson, which asserts the existence of a fundamental, genetically-based human need and propensity to affiliate with other living organisms and lifelike processes. It reviews research by Wilson and others that supports the biophilia hypothesis, and examines some of the issues and concerns that are at the forefront of the debate over the validity of the biophilia hypothesis. The paper then draws on structural-developmental psychological theory to expand Wilson's hypothesis in order to address perceived flaws in Wilson's original hypothesis. Finally, the paper discusses three studies conducted in the United States and the Brazilian Amazon on children's moral and ecological conceptions of the natural environment. The studies were found to support a structural-developmental account of biophilia. (Contains 65 references.) (MDM)

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A Developmental Inquiry into Biophilia: Children's Affiliation with Nature

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Abstract

A venturesome hypothesis has been put forth by E. O. Wilson, and is gaining increasing support. The hypothesis asserts the existence of biophilia, a fundamental, genetically-based, human need and propensity to affiliate with other living organisms and life-like processes. While the biophilia hypothesis, as conceived, can help us to understand the biological underpinnings of how humans come to value nature, this paper argues that the construct itself needs to include substantively ontogenetic considerations. Thus this paper advances an alternative means, grounded in structural-developmental psychological theory, by which to understand biophilia. Data from three recent studies conducted in the United States and the Brazilian Amazon are offered to support this reconception.

A Developmental Inquiry into Biophilia:

Children's Affiliation with Nature

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What is biophilia? And why is it important for developmental psychologists to understand and study it? As for many questions, there is a short answer and a long answer.

The short answer is this. The biophilia hypothesis asserts the existence of a fundamental, genetically-based, human need and propensity to affiliate with life and lifelike processes. Consider, for example, that recent studies have shown that even minimal connection with nature -- such as looking at it through a window -- increases productivity and health in the work place, promotes healing of patients in hospitals, and reduces the frequency of sickness in prisons. Other studies have begun to show that when given the option humans choose landscapes such as prominences near water from which parkland can be viewed that fit patterns laid down deep in human history on the savannas of East Africa. Wilson (1992) points out that people crowd national parks to experience natural landscapes, and "travel long distances to stroll along the seashore, for reasons they can't put into words" (p. 350). According to Wilson (1984), the biophilic instinct emerges often unconsciously, in our cognition, emotions, art, and ethics, and unfolds "in the predictable fantasies and responses of individuals from early childhood onward. It cascades into repetitive patterns of culture across most or all societies" (p. 85). Thus what makes the hypothesis particularly important is that it provides an overarching framework by which new scientific ground across many disciplines can be charted that bear on understanding the human relationship with nature.

The long answer -- which is not nearly as tidy -- is the subject of this article. It is my hope to bring this line of inquiry more fully into the field of developmental psychology.

In Section I, I sketch some of the promising research that supports and flesh out the biophilia hypothesis. This task is important, for the idea of biophilia becomes compelling not by any single study, but by the confluence of research from diverse fields. This body of research also sets into motion the issues and concerns that are at the forefront of current debate, and which I take up in Sections II and III. Some of these controversies engage classic issues going back at least to the 1970's on the adequacy of sociobiological theory to explain human behavior. In terms of biophilia, the question arises of whether the biophilia construct must be leashed closely to a genetic history. The shorter the leash, the more genetic determinism governs the construct, and the more the classic critiques of sociobiology come to bear on the biophilia construct. I will suggest that sociobiological theory sometimes constrains the biophilia construct, and other times asks more of it than it can deliver. I by no means, however, seek to take the biology out of biophilia, as much as provide it with a more comprehensive base.

Thus in Section IV, I draw on structural-developmental psychological theory to offer such an expanded base, one that can address two overarching problems. One problem sociobiologists call "the problem of altruism." Namely, if as sociobiologists maintain humans act in ways that promote their reproductive success, how can the theory account for seemingly altruistic acts -- from simple acts of generosity to a person risking his or her life to save a stranger? For such behavior would seemingly decrease an individual's survival opportunities. The second problem directly bears on the biophilia

hypothesis. If humans have a biophilic instinct (to affiliate with life), do they not also a biophobic instinct (to disaffiliate with aspects of life, such as with snakes, spiders, or confining landscapes)? If so, then from the standpoint of genetically grounded environmental ethics, it would seem that biophobic actions (that dominate or harm aspects of nature) have equal standing to biophilic actions. Both problems, I will suggest, can be approached by drawing on the ontogenetic concept and psychological process of hierarchical integration, whereby earlier forms of knowledge do not disappear in development, but are reworked, transformed into more adequate and comprehensive structures.

Finally, in Section V, I turn to three studies colleagues and I have conducted on children's moral and ecological conceptions of the natural environment. In one study, we examined children's moral and ecological reasoning about the Prince William Sound oil spill. In a second study, we examined the environmental views and values of African-American children in an urban community in Houston, Texas. In a third study, we modified the methods from the Houston study and interviewed in Portuguese fifth-grade Brazilian children who lived along the Rio Negro either in the city of Manaus (the capital of the state of Amazonas) or a small remote village five hours boat ride up river. All three studies support a structural-developmental account of biophilia, and highlight the importance of such investigations. Equally important, the studies, taken together, provide a sense of how research might proceed on understanding the human relationship with nature.

I. The Biophilia Hypothesis -- Empirical Support and Amplifying Evidence

Several years ago, Wilson and Kellert hosted a four-day meeting on the biophilia hypothesis, and brought together upward to twenty eminent scientists and scholars across such disciplines as psychology, biology, anthropology, medicine, philosophy, urban planning, zoology, and political science. Based on this meeting, papers have been published in an edited book (Kellert & Wilson 1993). In the book's introduction, Kellert (1993) says: "Our labors will have been successful if we legitimize and stimulate future inquiry into this critical element of the human condition. Our grandest aspiration is to build the foundation and confidence for further systematic and deep examination of the biophilia hypothesis" (p. 21). To a substantial degree, the following summary of research comes from this volume.

Aesthetics and Habitat Selection. By most evolutionary accounts, human beings lived for most of two million years on the savannas of East Africa. During this time, it is believed that certain features of landscape offered greater chances for individual and group survival. For example, bodies of water not only provided a physical necessity to individuals, but presumably a perimeter of defense from most natural enemies. Bodies of water also drew forth other animals and plant life on which humans depended. Prominences overlooking grass lands presumably afforded views of approaching threats posed by certain animals or inclement weather. Trees with relatively low trunks presumably allowed accesses for climbing, while those also with relatively high canopies did not block the view. Flowers presumably indicated food sources.

Based on this evolutionary account, Wilson (1984) asks rhetorically: "[I]s the mind predisposed to life on the savanna, such that beauty in some fashion can be said to lie in the genes of the beholder?" (p. 109).

Research bears on this proposition. Orians and Heerwagen, for example, analyzed the changes in landscape that were recommended by a well-known eighteenth century British landscape architect. They hypothesized that if "humans have an intrinsic bias for particular kinds of landscapes and landscape elements, it should be possible to see this bias in the features and elements that are added to environments to enhance their appeal" (Orians and Heerwagon, 1992, p. 19). Their results supported

this hypothesis. In another of their studies, 75 people answered a photoquestionnaire that asked them to rate the relative attractiveness of a number of different types of trees. One finding was that tree shapes associated with rich African savannas were rated more attractive than other tree shapes. In another study by Heerwagen (1991; cited in Heerwagen & Orians, 1993) of the post-occupancy of seven office buildings in the Pacific Northwest, it was found that half of the 260 people surveyed had added plants or flowers to enhance their work space.

An unusual study was conducted in a psychiatric hospital in Sweden on the effects of the visual representation of nature. Based on records kept during a fifteen year period, it was found that patients often complained of many of the paintings and prints that the psychiatric hospital displayed. Seven times over this fifteen year period patients attacked a painting or print (e.g., tearing a picture from a wall and smashing the frame). Each time the painting or print substantially consisted of abstract art. In contrast, there was no recorded attack on wall art depicting nature (see Ulrich, 1993). These findings are consistent with a study by Ulrich (1993) where it was found that short term psychiatric patients responded favorably to wall art that involved nature (a rural landscape or a vase of flowers) but tended to react negatively to abstract painting and prints in which the content was either ambiguous or unintelligible.

Non-Western cross cultural studies on the preference of natural versus urban landscapes have also been conducted. Chokor and Mene (1992), for example, presented Nigerian subjects with photographs of urban and rural scenes drawn from and around the city of Warri, Nigeria. They found that "all groups of respondents, whether poor, rich, educated or uneducated, or located in an urban or rural area, exhibited a strong preference for natural landscapes and expressed a common yearning for modern, planned urban scenes with natural elements and landscaping. Urban scenes without nature were particularly viewed by urbanites as 'ugly' and 'disgusting'" (pp. 254-255). These findings are in line with other studies that show that European, North American, and Asian adults responded with high affective responses to environments that resembled savannas or open parks (see Ulrich, 1993, for a summary). In addition, a reliable finding is that natural settings that feature water elicit especially high levels of liking or preference, unless the water configuration involves risk (a stormy sea) or contains clearly visible pollution (Ulrich 1993).

Physiological and Psychological Well-Being in Response to Natural Landscapes. If through evolution certain natural landscapes have promoted human survival and reproductive success, then it may have come to pass that such landscapes nurture the human physiology and promote a sense of emotional well-being. Research also bears on this proposition. Findings from over 100 hundred studies, for example, have shown that stress reduction is one of the key perceived benefits of recreating in a wilderness area, especially in those settings that resemble the savanna (Ulrich, 1993).

Other studies have examined the relative effects of natural and urban settings to reduce stress. For example, in one study (Ulrich, Simons, Losito, Fiorito, Miles, & Zelson, 1991) 120 subjects were exposed to a stressful movie, and then to videotapes of either natural or urban settings. Data were collected not only by means of self-report, but through a battery of physiological measures that included heart period, muscle tension, skin conductance, and pulse transit time. Overall, findings showed greater stress recovery in response to the natural than urban settings.

Other studies conducted in prisons, dental offices, and hospitals point to similar effects. For example, Moore, E. O. (1982; cited in Ulrich, 1993) found that prison inmates whose cells looked out onto nearby farmlands and forests needed less health care services than inmates whose cells looked out onto the prison yard. In a dental clinic, Heerwagen (1990) presented patients with either a large mural depicting a spatially open natural landscape or no mural at all. Patient data included heart rate measurements and affective self-ratings. Results suggest that patients felt less stressed on days when

the mural was present. Other's have studied the effects of displaying different ceiling-mounted pictures to presurgical patients who were lying on gurneys (Coss, 1990, summarized in Ulrich, 1993). Systolic blood pressure was measured in three different conditions. In one condition, a picture depicted a nature scene that included water; a second condition portrayed an "exciting" outdoor scene that involved a sailboarder leaning into the wind; a third condition involved no picture at all. Findings show that after a relatively brief period of exposure (three to six minutes) that presurgical patients had systolic blood pressure levels that were 10-15 points lower in the condition that involved the serene nature picture than in the other two conditions.

Studies conducted in other hospitals have shown related findings. In one fascinating study, for example, Ulrich (1984), examined the potential differences in the recovery of patients after gall bladder surgery depending on whether the patients were assigned to a room with a view of a natural setting (a small stand of deciduous trees) or a view of a brown brick wall. Patients were paired on relevant variables that might effect recovery (e.g., age, sex, weight, tobacco use, and previous hospitalization). The results shows that "patients with the natural window view had shorter postoperative hospital stays, and far fewer negative comments in nurses' notes ('patient is upset,' 'needs much encouragement') and tended to have lower scores for minor postsurgical complications such as persistent headache or nausea requiring medication. Moreover, the wall-view patients required many more injections of potent painkillers, whereas the tree-view patients more frequently received weak oral analgesics such as acetaminophen" (Ulrich, 1993, p. 107).

In extending this research, Ulrich and Lunden (1990) randomly assigned 166 patients undergoing open-heart surgery with visual stimulation of a two different types of nature pictures (either an open view with water or a moderately enclosed forest scene), an abstract picture, or a control condition consisting of either a white panel or no picture at all. Their findings suggest that the patients exposed during surgery to the picture of an open nature view with water experienced much less postoperative anxiety than the control groups and the groups exposed to the other types of pictures. This finding not only points to the effect of natural scenes in promoting recovery, but is consistent with the savanna hypothesis, given the lack of recovery when patients were exposed to the enclosed forest picture.

Affiliation with Animals. If biophilia is understood as an affiliation with life and lifelike processes, then analyzing our relations to animals should provide data consistent with the Biophilia hypothesis. Lawrence (1993) provides one such line of analysis in a lively essay titled "The Sacred Bee, the Filthy Pig, and the Bat Out of Hell: Animal Symbolism as Cognitive Biophilia." She reasons that if humans have a deeply grounded affiliation with animals, then such affiliation should find pervasive expression in our language and cognition. Even cursory passes at our everyday language point to rich examples. We use "expressions like porker, hogwash, male chauvinist pig, gas hog, road hog, living high on the hog, happy as a pig in muck, going hog wild, piggish, and crying like a stuck pig. There are fascist pigs and Nazi pigs; prostitutes and policemen are called pigs" (p. 325). Claude Levi-Strauss says that animals are "good to think" as well as good to eat; Lawrence shows that this dictum holds true not only for primitive cultures but for complex modern societies.

Like with landscapes, perhaps even more so, it appears that human contact with animals promotes physiological health and emotional well-being. Consider, for example, the common aquarium that -- at least in years past -- inhabit waiting rooms in many dental offices. Does the conspicuous placement of these aquariums reflect but an arbitrary cultural convention? In a simple experiment, Katcher, Friedmann, Beck, & Lynch (1983) found that watching an aquarium resulted in significant decreases in blood pressure below the resting level in both hypertensive and normal subjects. In a more detailed experiment, Katcher, Segal, and Beck (1984) examined the influence of aquarium contemplation on patients about to undergo oral surgery. After the surgery, assessments of the patients' comfort level

during surgery were made by the oral surgeon (who was unaware of the nature of the pretreatment), an observer, and the patient. Results showed that aquarium contemplation was as effective as hypnosis in relaxing patients and in increasing their comfort level during surgery.

More generally, it has been found that experience with animals positively effects human welfare, especially for people who have organic or functional mental disorders (see Katcher, 1993 for a review). For example, hundreds of clinical reports show that when animals enter the lives of aged patients with chronic brain syndrome (which follows from either Alzheimer's disease or arteriosclerosis) that the patients smile and laugh more, and become less hostile to their caretakers and more socially communicative. A number of studies show similar findings with autistic children. Through interactions with animals (such as a dog, cat, bird, dolphin, or even small turtle), it has been shown that autistic children have more focused attention, social interaction, positive emotion, and speech. Similar results have been found for people with various functional mental disorders. Moreover, according to Katcher and Wilkins (1993), "all the desirable responses to animals in therapeutic situations reflect the influence of interaction with companion animals within the general population" (pp. 180-181).

"Native" Biophilia in Native Peoples. One last line of inquiry -- from an entirely different direction -- is worth summarizing. The inquiry gets set up in something like the following way. "It's all well and interesting to study biophilia in today's modern age. But don't you know that many native people never had to study biophilia because they lived it; their lives were deeply connected to nature, their affiliations pervasive across most if not all aspects of their lives. Thus if you want to study biophilia, study the 'native' biophilia of native peoples."

One of the most sensitive inquiries of this kind has been developed by Nelson (1983, 1989, 1993) in his extensive study of the Koyukon in Northern Alaska. As partial support for the ways in which the Koyukon affiliate with nature, Nelson points to these people's detailed, extensive, and accurate knowledge of their natural environment. Volumes could be written based entirely on Eskimo knowledge according to Nelson (1993, p. 208) about the behavior, ecology, and utilization of arctic animals, including polar bear, walrus, bowhead whale, belunga, bearded seal, ringed seal, caribou, musk and ox. Indeed, Nelson suggests that "the expert Inupiaq hunter possesses as much knowledge as a highly trained scientist in our own society, although the information may be of a different sort" (p. 208).

The Koyukon not only have knowledge about animals but appear to learn from them, and cooperate with one another for mutual advantage. Eskimo methods for hunting seals, for example, are essentially identical to those of the polar bear. Nelson wonders whether this is a case of independent invention, or even convergent evolution, or whether -- as I suspect Nelson believes -- "Eskimos learned the techniques by watching polar bears, who had perfected an adaptation to the sea ice environment long before humans arrived in the arctic" (Nelson, 1993, p. 210). Or consider another example. The raven is often considered to bring luck if sighted during a hunt, and has been known to lead hunters to their prey. Coincidences? Folklore? Nelson (1989) asks:

> Does the raven really care about things, does he really know, does he move with the power Koyukon elders hold in such great regard?...if the raven has power, does he recognize it himself and use it consciously? Koyukon hunters say he does. If the raven brings you luck it's to serve himself, because he will eat whatever you leave for him from the kill. (p. 25)

Thus the Koyukon appear to enter with animals into something like a symbiotic relationship.

Such affiliations with animals are woven into the moral and religious fabric of Koyukon life. According to Koyukon elders, no animal should be considered inferior or insignificant. Each deserves respect (Nelson, 1989, pp. 23 & 160). Nelson (1993) records that a "Koyukon woman described praying to a raven when she was desperately sick, then explained: 'It's just like talking to God; that's why we pray to ravens'" (p. 214). And Nelson (1989) comes to recognize that when Koyukon speak to the Raven, they draw on emotions as elemental as devout Christians feel when they pray to God" (pp. 242-243).

According to Koyukon teachers, all are part of a living community. It is a community that includes not only humans and animals, and not only plants, but mountains, rivers, lakes, storms -- the earth itself. Nelson (1989) writes:

> According to Koyukon teachers, the tree I lean against feels me, hears what I say about it, and engages me in a moral reciprocity based on responsible use. In their tradition, the forest is both a provider and a community of spiritually empowered beings. There is no emptiness in the forest, no unwatched solitude, no wilderness where a person moves outside moral judgment and law. (p. 13)

Thus, according to Nelson, the Koyukon worldview expands the very meaning of biophilia. It "carries us beyond the idea that humans have a tendency to affiliate with other life...to the possibility that our fellow creatures also have a tendency to affiliate with you" (Nelson, 1993, pp. 214-215).

Nelson is trained as a Western anthropologist, and is all too aware of the skepticism which greets his research. Yet he persists. He argues that for 99 percent of our history human beings lived exclusively as hunter-gathers. On a relative time scale, agricultural societies have existed only briefly, urban societies even briefer.

> From this perspective, much of the human lifeway over the past several million years lies beyond the grasp of urbanized Western peoples. And if we hope to understand what is fundamental to that lifeway, we must look to traditions far different from our own...Probably no society has been so deeply alienated as ours from the community of nature, has viewed the natural world from a greater distance of mind, has lapsed to a murkier comprehension of its connections with the sustaining environment. Because of this, we are greatly disadvantaged in our efforts to understand the basic human affinity for nonhuman life. Here again, I believe it's essential that we learn from traditional societies, especially those in which most people experience daily and intimate contact with land...." (1993, pp. 202-203)

Summation. Through this section, I have sought to amplify what is meant by biophilia, and to make the hypothesis compelling. Thus I have summarized a wide range of literature. No single line of evidence is meant to stand alone. But taken together, the research is reasonably impressive, especially since none was conducted under the rubric of the biophilia hypothesis.

The research suggests, for example, that people usually enjoy viewing landscapes that fit patterns laid down deep in human history on the savannas of East Africa. Experience with or even a visual representation of such landscapes -- or key features of landscape (such as flowers) -- appears to work powerfully within the human physiological and psychological systems. It appears that even minimal experiences with nature can reduce immediate and long-term stress, reduce sickness of prisoners, calm patients before and during surgery, and promote healing after surgery. Direct contact with animals has been shown to greatly benefit a wide range of clinical patients: from adults with Alzheimers disease to autistic children. Animal images and metaphors appear woven into the fabric of the English language if not the human mind. Moreover, if native peoples offer us a way to understand

what is most basic to our being, then the evidence from the Koyukon of Northern Alaska speak to pervasive affiliations with nature that run deep in our evolutionary history.

No wonder, then, that Wilson (1984) points out that real estate prices are comparatively high for bluff top land that overlooks bodies of water (lakes, rivers, oceans). If cost is commensurate with desirability, such a finding follows from a biophilic account of aesthetics and habitat selection. Or no wonder, as Wilson notes, that in North America each year more people visit zoos than all sporting events combined. And it would appear far more than just a cultural convention that flowers are often sent to sick people in a hospital. The need and propensity to affiliate with nature appears great.

But Biophilia remains at this point a conjecture, an hypothesis. And if biophilia has the potential to provide a framework for a full-bodied interdisciplinary research agenda on understanding the human relationship with nature -- and I think it does -- then at this point a critical perspective needs to be brought to bear. For biophilia is not without its problems. And these problems need to be brought out in the open, confronted head on, for a compelling and robust framework to emerge.

II. Biophilia and Genetic Determinism

One of the fundamental concerns that has been voiced about the biophilia hypothesis centers on the extent to which biophilia is genetically shaped, if not determined. In a review, for example, in Science of Kellert and Wilson's (1993) edited book The Biophilia Hypothesis, Fischer (1994) opens by saying that "Wilson and his colleagues have identified yet another human behavior they suspect is governed by genes -- nature appreciation" (p. 1161). According to Fischer, to the extent the biophilia hypothesis embodies a genetic determinism, the hypothesis is deeply flawed; to the extent it does not, the hypothesis is "largely hollow" (p. 1161).

Fischer's critique of biophilia follows from a more general critique of the sociobiological program launched with the publication of Wilson's (1975) Sociobiology: The New Synthesis. Thus I should first like to attend briefly to this larger literature. In his 1975 treatise, Wilson argues that our complex behavioral responses are little more than genetically programmed behaviors to maximize genetic fitness. This perspective can be well illustrated by sketching the answer to what Wilson and others call "the problem of altruism." The problem is this. If it is true that people act so as to increase their reproductive fitness, how can altruistic behavior be explained, since it seemingly reflects behavior that decreases an individual's reproductive fitness for the sake of others. Sociobiologists have suggested two types of answers: reciprocal altruism and kin selection. Roughly stated, Trivers (1971) has proposed that often when we help others we do so because at some point we ourselves may be in need of help. In other words, because of reciprocal altruism a certain amount of helping behavior is in fact in our best interest. Other times we also help genetically-related family members because they share common genes, and to help them is to increase the reproductive success of our common gene pool. "This enhancement of kin-network welfare in the midst of a population is called kin selection" (Wilson, 1975, p. 116; cf. Hamilton, 1964).

Accordingly, Wilson (1975) says that it may well be "that the time has come for ethics to be removed temporarily from the hands of the philosophers and biologized" (p. 287). Elsewhere, Wilson says that "[m]orality, or more strictly our belief in morality, is merely an adaptation put in place to further our reproductive ends....In an important sense, ethics as we understand it is an illusion fobbed off on us by our genes to get us to cooperate" (Ruse & Wilson, pp. 51-52). In other words, we have been genetically programmed to think and feel as if we freely make ethical choice; but such thoughts and feelings are epiphenomenal in that they play no authentic causal explanation for our behavior.

Moving beyond ethics, Wilson more boldly concludes his 1975 treatise by saying that in the final analysis psychology, sociology, and the other human sciences will be reducible to neurobiological processes: "Cognition will be translated into circuitry. Learning and creativeness will be defined as the alteration of specific portion of the cognitive machinery....To maintain the species indefinitely we are compelled to drive toward total knowledge, right down to the levels of the neuron and gene" (p. 575). According to Wilson, when "we have progressed enough to explain ourselves in these mechanistic terms," the result -- "a world divested of illusions" -- might be hard to accept, but true (p. 575).

Wilson anticipated rightly. Such a result has been hard for many people to accept. At least two approaches toward critiquing sociobiology have emerged.

Through one approach, critics have gone after the sociobiological program directly, and taken it to task for substantive flaws in its methods, science, logic, and use of evidence. Consider a common method that sociobiologists employ to build their theory. Some pattern of behavior in animal species is found that appears similar to what people do. Then both pieces of behavior are named the same thing. Then evidence is acquired for the existence in animals of a genetic predisposition to the behavior, and then sociobiologists announce the general result that there is genetic basis for this type of behavior in humans (see Kitcher, 1985, p. 185).

In the literature, for example, sociobiologists have used "rape" to describe not only human behavior, but the behavior of scorpions, flies, and ducks. Barash (1979), for example, says that among ducks "sometimes strange males surprise a mated female and attempt to force an immediate copulation, without engaging in any of the normal courtship ritual and despite her obvious and vigorous protest. If that's not rape, it is certainly very much like it" (quoted in Kitcher, 1985, p. 185). Barash then suggests through "rape" male ducks might maximize their genetic fitness; and that perhaps "human rapists, in their own criminally misguided way, are similarly doing the best they can to maximize their fitness" (quoted in Kitcher, 1985, p. 186).

The problem is that an enormous and often unsubstantiated jump occurs in moving from animals to humans. In a counter-argument, for example, Kitcher (1985) suggest that rape has complicated social and not just genetic origins that involve prevalent social conceptions of the role of women and male status. Applying the term rape to certain instances of copulation among ducks is to misunderstand the distinctly human origins of rape, and to trivialize such explanations. Moreover, even on genetic grounds Kitcher calls into question whether male hominids would increase their genetic fitness through rape. After all, rapists are frequently attacked or punished, and accordingly there should be a decrease in their reproductive success. In addition, rapes frequently take place on humans who cannot conceive (e.g., children, women past the age of menopause, and on members of the same sex). "Of course," Kitcher writes, "sociobiologists could contend that such behavior is a by-product of mechanisms that were selected under different conditions" (p. 187). But Kitcher remains unconvinced in that such "special pleading takes cover in our ignorance of the hominid social environment, in an effort to accommodate troublesome facts that are all too obvious" (p. 187). Many others have similarly been concerned with the sociobiological bent to tell "just so" stories -- post hoc accounts without enough specificity to rule out competing and seemingly more compelling explanations (Diamond, 1993; Katcher & Wilkins, 1993; Fischer, 1994).

While one approach seeks to critique the sociobiological program directly, another approach seeks to reinstate the primacy of non-biological constructs. For example, imagine three situations where a fellow named Bob goes for a walk in the woods. In situation 1, a boulder above Bob is dislodged by an earth tremor; it falls on Bob and kills him. As unfortunate as this situation is for Bob, we would not normally say that the boulder acted immorally. In situation 2, a lion on the hunt pounces from out of the woods and kills Bob (and feeds her family on him). Again, from Bob's standpoint this situation is

most unfortunate; but we would not normally say that the lion acted immorally, even though the lion is a biological animal. Finally, in situation 3, a bandit jumps out of the woods and kills Bob in the process of robbing him. It is only in this latter situation that we normally would say something unethical or immoral has occurred.

Why do we say this? Presumably because we believe that ethics is something distinctly human, and that an account of our ethical judgment extends beyond our biological base as an animal. Granted, there may be no way ultimately to prove such an account, in the same way there may be no way to prove that you, the reader, are not actually at this moment a brain in a vat being stimulated by electrical currents. But the phenomenological experience of our lives speaks against the latter position, as does the phenomenological experience of our ethical judgments speak against the reduction of ethics to biology. Thus, in critiquing sociobiology this other approach seeks to reinstate the primacy of such central human constructs as altruism, morality, free will, and human agency -- to reinstate them in the sense that such constructs play authentic causal roles in human lives.

Concerns like these just begin to touch on the enormous critical literature on sociobiology. I am not sure, however, that there is a need to develop these critiques much further. For it is not clear that Wilson or his colleagues want to understand biophilia in a stringent biological sense. For example, in an unpublished response to Fischer's (1994) critique of biophilia noted above, Kellert (1994) argues strongly that Fischer has "oversimplified and exaggerated the biological determinism articulated" in the book.

Kellert's point is well taken, for Wilson at times seems to recognize the paramount importance of learning, cognition, and culture in explaining human nature. For example, Wilson (1993) says that biophilic behavior, "like other patterns of complex behavior, is likely to be mediated by rules of prepared and counterprepared learning" and that the multiple strands of the biophilic emotional response "are woven into symbols composing a large part of culture" (p. 31). Furthermore, just consider the diverse range of people he and Kellert asked to contribute to the conference and subsequent book on the biophilia hypothesis. Many of the contributors focused on the religion and practices of native peoples (Diamond, 1993 Gadgil, 1993; Nelson, 1993; Nabhan & Sg. Antoine, 1993), myths (Sheppard, 1993), language symbolism (Lawrence, 1993), cognitive processing (Ulrich, 1993), and environmental philosophy (Rolston, 1993). Hardly a reductionist collection. Moreover, Wilson writes -- often eloquently -- of seemingly irreducible qualities of human life; that is, qualities largely unleashed from their biological components. For example, Wilson (1992) writes that an "enduring environmental ethic will aim to preserve not only the health and freedom of our species, but access to the world in which the human spirit was born" (p. 351). Before that he writes that we "do not understand ourselves yet and descend farther from heaven's air if we forget how much the natural world means to us. Signals abound that the loss of life's diversity endangers not just the body but the spirit" (p. 351). Elsewhere, Wilson (1984) writes that "our spirit is woven from it [biophilia], hope rises on its currents" (p. 1). Freedom, spirit, heaven's air, and hope rising on biophilic currents. These are not human constructs easily understood in terms of a genetic biological determinism.

At the same time, however, what are we to make of other parts of Wilson's even recent writings? In one of his recent books Wilson (1993) asks how biophilia could have evolved. He answers that the

> likely answer is biocultural evolution, during which culture was elaborated under the influence of hereditary learning propensities while the genes prescribing the propensities were spread by natural selection in a cultural context...a certain genotype makes a behavioral response more likely, the response enhances survival and reproductive fitness, the genotype consequently spreads through the population, and the behavioral response grows more frequent. (pp. 32-33)

This explanation embodies the hard biological stance of the early sociobiological program: Genes that lead to behaviors that enhance survival tend to reproduce themselves (since they are in bodies that procreate more rather than less), and thus these genes and correlative behaviors grow more frequent. In this sense, human behavior (including biophilic behavior) is orchestrated if not directed and determined by genes.

Such a deterministic account need not diminish an interest in culture. Wilson is interested, for example, in Nelson's telling of the myths of the Koyukon. But it is one thing to say that what the Koyukon believe to be true really is true -- that, for example, trees really feel and hear people. It is another thing to say, as I think Wilson does, that having such (mis-)beliefs (myths) about nature often can enhance survival fitness. Myths are neither irrelevant nor uninteresting; but they do not hold an explanatory place in understanding human behavior; biology does.

Thus, in different places, Wilson offers differing accounts of biophilia and its genetic basis. Indeed, Wilson sometimes captures differing accounts within single sentences. For example, Wilson (1984) says that the premises of a conservation ethic need to change "into forms more suited to ultimate survival, by which I mean protection of the human spirit" (p. 140). "Ultimate survival" evokes genetic determinism; "human spirit" does not. Or, Wilson says: "The more the mind is fathomed in its own right, as an organ of survival, the greater will be the reverence for life for purely rational reasons" (p. 140). The mind "as an organ of survival" evokes genetic determinism; "reverence for life" does not.

I am not the only person who has been confused about Wilson's perspective on genetic determinism. Kitcher (1985), for example, says that "Wilson's subsequent writings abound with explicit disavowals of the view that genes determine human behavior and with metaphors intended to convey his ideas about the relation between genes and behavior. Yet critics galore follow Gould in contending that Wilson cannot be serious" (p. 22). Thus, some critics have accused Wilson of sloppy scholarship, employing verbal tricks, or being academically clever. In my own view, there may be a wholly different explanation for the frustration scholars have had in interpreting Wilson's position. Namely, it may be the case that because Wilson is steeped in the biological sciences, and his humanistic and moral perceptions -- so tangible that he can almost touch them, but so ephemeral that they allude capture analytically -- arise out of that very grounding. If so, then he would necessarily struggle with conveying his perceptions in biological terms to colleagues outside the biological disciplines; and he would well turn to eloquent metaphors and language to convey what he assumes people inaccurately are not seeing in his more rigorous science.

But, be that as it may, it is time to leave aside Wilson's ambiguity. The more important issue is this: If biophilia is understood in stringent biological terms, it will increasingly run up against the opus of formidable critiques that have been extensively leveled against the sociobiological program, especially the program in its early forms. And there is no need for biophilia to be understood in this way. Rather there are softer biological versions of biophilia (and not "largely hollow" ones), and it is such a version which I will shortly begin to articulate.

III. The Relation between Biophilia and Biophobia

Toward offering an expanded account of biophilia, it is first necessary to attend to a perplexing question about the construct, and it occurs whether biophilia is understood in deterministic or non-deterministic biological terms. The question is this: What is the relation between biophilia (a seemingly positive affiliation with nature) and what Orr (1993), Ulrich (1993), and others have recently termed biophobia (a seemingly negative affiliation with nature). After all, snakes and spiders scare most of us. Bogs and swamps can seem unappealing. Dark woods can feel threatening. In other words, granting

that people at times find nature unlikable and unfriendly, if not threatening and harmful, then what becomes of biophilia?

In the recent literature, one answer that has emerged is that biophilia and biophobia exist separately. Orr (1993), for example, says that biophobia "ranges from discomfort in 'natural' places to active scorn for whatever is not man-made, managed, or air-conditioned...[It is the] urge to affiliate with technology, human artifacts, and solely with human interests regarding the natural world" (p. 416). Elsewhere, Orr says that in the same way that love stands in contrast to hate, and life to death, so must we choose biophilia over biophobia. Biophobia "is not OK because it is the foundation for a politics of domination and exploitation" (p. 420). Thus by demarcating the two terms, biophilia and biophobia, Orr is able to speak of each separately, and value each differently.

Ulrich (1993) similarly contrasts biophilia and biophobia, but he does so in order to try to provide a clean empirical method for their investigation. Ulrich, for example, reports on numerous conditioning and counter-conditioning experiments using biophobic stimuli (e.g., pictures of snakes, spiders, heights, closed spaces, and blood). The research suggests that "humans are biologically prepared to acquire and especially to not 'forget' adaptive biophobic (fear/avoidance) responses to certain natural stimuli and situations....Moreover, recent findings suggest that processing of biologically prepared fear-relevant natural stimuli can be very fast and may often occur automatically or 'unconsciously'" (p. 85). In his article, Ulrich provides a remarkable synthesis of hundreds of studies on negative affiliations with certain aspects of nature (biophobia) and contrast those studies with emerging research (summarized in Section I) on positive affiliations with nature (biophilia).

Interestingly, however, Wilson himself sets up a different relation between biophilia and biophobia. Recall that Wilson defines biophilia as an affiliation with life and life-like processes. In this framing of biophilia, people have both positive and negative affiliations with life. These complex feelings "fall along several emotional spectra: from attraction to aversion, from awe to indifference, from peacefulness to fear-driven anxiety" (Wilson 1993, p. 31). Thus, according to Wilson, biophilia says something about the sense of integration of life affirming and life-disaffirming propensities.

Now, if we take seriously that biophilia subsumes both life affirming and life disaffirming propensities, a puzzle arises. How can we know which actions are part of the resulting conservation ethic? Consider, for example, a vivid anecdote that Diamond (1993) provides of his experiences with native peoples in New Guinea:

> I found men intentionally inflicting pain on captured live bats for no other reason than amusement at the reactions of the tortured animals. The men had tied twenty-six small Syconycteris blossom bats to strings. The lowered on bat after another until it touched the red-hot embers of a fire, causing the bat to writhe and squeal in pain. The men raised the bat, lowered it again for another touch to the red-hot embers, repeated this process until it was dead, and then went on to the next bat, finding the whole proceedings funny." (pp. 263-264)

Can one torture animals and say that through disaffirming that animal's life one is biophilic? Why not? Presumably it is this sort of problem that led Orr to separate biophilia from biophobia, and argue for the ethical superiority of the former. Or consider a situation that might appear justifiable on evolutionary grounds; namely, logging the virgin timber in the Amazon rain forests. After all, as Ulrich (1993) notes, the Amazon forests are associated with greater risks than the African savannas because of the rain forest's "higher levels of biophobic properties, including spatial enclosure and higher probabilities of encountering close hidden threats, including snakes, spiders, and other fear-relevant stimuli" (p. 118). Thus it would "naturally" follow that humans would want largely to clear cut the dense forests and recreate them into savanna like settings. Does such a biological account justify the current deforestation

of the Amazon? In other words, what actions count as biophilically life disaffirming, and are thus part of the conservation ethic, and on what basis are those actions distinguished from life disaffirming actions that lie outside the ethic?

I assume Wilson has an answer, and it would go something like this: Since certain life affirming actions (perhaps feeding one's dog) and life disaffirming actions (perhaps shooting a rabid animal) can promote our genetic fitness, whenever we seek to determine which actions to pursue, all we need to determine is which actions do so. Thus, for example, swatting mosquitoes may promote our genetic fitness, torturing bats may not; sustainable logging might, clear-cutting rain forests may not; and so on. This is what I take Wilson (1984) to mean when he says that the "only way to make a conservation ethic work is to ground it in ultimately selfish reasoning -- but the premises must be of a new and more potent kind" (p. 131). To this point, the sophistication of Wilson's theorizing illuminates in the sense that we are better positioned to understand and investigate the complex psychological coordinations of seemingly disparate reactions to nature ("from attraction to aversion, from awe to indifference, from peacefulness to fear-driven anxiety").

But Wilson's account also reduces biophilia to the selfish gene, and thus becomes weakened by various forms of the counter arguments to the early sociobiological program sketched in the previous section. Namely, a problem arises in trying to use biophilia as a biological proposition to justify biophilia as a normative or moral proposition. To do so is to commit the naturalistic fallacy (cf. Hume, 1751/1983; Moore, G. E., 1903/1978): to reason that an account of what "is" necessarily leads to an "ought," that natural forms necessarily make the moral. To underscore this problem, consider Wilson's position on aggression. According to Wilson (1978), "primitive warfare evolved by selective retention of traits that increase the inclusive genetic fitness of human beings" (p. 112). At some point in human warfare, aggression is counterproductive, according to Wilson; that is, the energy expended and the risk of injury and death outweigh the energy saved and the increase in survival and reproduction. But till that point -- till which aggression confers genetic advantage -- a good deal of blood-filled battles can be fought, women raped, children killed, with "moral" sanction. The word moral is in quotation marks because Wilson, in effect, suggests that if an action confers genetic advantage it is moral, which appears to trivialize the term.

In brief, Wilson has offered compelling evidence that humans have an instinctual need to affiliate with other living organisms. Wilson has also I think rightly conceived of biophilia broadly enough such that it includes both positive and negative affiliations. But it does not follow that biophilia in its various biological manifestations necessarily ought to have any moral standing. For such a move, biophilia needs a theoretical foundation that extends beyond its genetic base.

IV. A Structural-Developmental Conception of Biophilia.

If we are to take seriously an account of human nature that is more than biology, and more than biologically prepared learning, than what might a conceptualization of biophilia look like, and what sort of research can support it? In this section, I begin to offer a response. I draw briefly on work by Lawrence Kohlberg and James Mark Baldwin to characterize several central features of structural-developmental theory. I suggest the theory can offer a potentially powerful means by which to expand the base on which to ground the biophilia construct, and to provide it with an ontogenetic framework.

In his moral developmental stage theory, Kohlberg (e.g., 1964, 1971, 1984) proposes that children and adults reason morally, that such reasoning is largely coherent (structured), develops, and, in development, is hierarchically integrated. To illustrate these ideas, consider stage-related types of reasoning about conflicts that involve competing claims between self and other. From the perspective of Kohlberg's theory, in stage 1 there is moral consideration only for the self (punishment avoidance). In

stage 2, there is consideration for another person, but only instrumentally (instrumental hedonism), as in "I'll scratch your back if you scratch mine." Stage 2 represents an advancement over stage 1 in that there can be consideration for others. Interestingly, it is this level that captures what Wilson views as a central feature of morality: reciprocal altruism. In seeking to explicate this moral conception, Wilson says that the "conventions of this mode of behavior are expressed in the familiar utterances of everyday life." Wilson (1975) provides several examples which take the following form: "Come to my aid this time, and I'll be your friend when you need one" (p. 553). Like Wilson, Kohlberg would agree that such familiar utterances reflect moral reasoning, and that the reasoning is essentially selfish. But based on scores of developmental studies, Kohlberg would also say that such reasoning does not reflect a developmental endpoint, but a stage 2 moral orientation. This essential selfishness transforms into a genuine caring for family members and other personal relations (stage 3), consideration for society at large (stage 4), and then humanity from a universal perspective (stages 5 and 6).

In terms of the idea of hierarchical integration, notice that the higher stages subsume the earlier ones. For instance, the legal codification emphasis of stage 4 includes considerations for self, other, and family, but it attempts to correct for the unfairness that can arise from basing moral judgments largely on interpersonal considerations (e.g., the unfairness of a judge who gives his family member or friend preferential treatment). It is in this sense -- in which the central organizing principle of an earlier stage, such as selfishness, becomes an element in a more inclusive organizational framework -- that stages represent transformations of moral knowledge, rather than simple replacements of one moral view with another.

One critique of Kohlberg's hierarchical stage theory (e.g., Selman, Jaquette, & Latin, 1977) is that the theory eschews the concept of regression and does not do justice to the dialectical micrographic processes of development (how development occurs in immediate situations, and situation-specific processing). While I suspect Kohlberg's theory stands up better to such criticism than is usually granted (see, Boyd, 1989), the criticism poses little problem for structural-developmental theory in general. This case can be made by looking at an early structural-developmental theorist writing around the turn of last century: James Mark Baldwin.

In his developmental theory -- which was roughly hewn, through broad and vigorous in scope -- Baldwin (1897/1973) proposed three stages in a young child's developing sense of self: the projective, subjective, and ejective. In the initial projective stage a child does not distinguish self from other, but blindly copies or obeys others, without understanding. In the subjective stage, the child makes the projective knowledge his own by interpreting the projective imitative copy within. Baldwin says "into his [the child's] interpretation go all the wealth of his earlier informations, his habits, and his anticipations" (p. 120). Finally, in the ejective stage, the child ejects his subjective knowledge onto others. Baldwin says that in this stage the child "reads back imitatively into them [other people] the things he knows about himself" (p. 418).

What claims does Baldwin make about these stages? In part, Baldwin believes they follow sequentially: that there is a developmental movement from copying unreflectingly (stage 1), to increased interpretative reflectivity (stage 2), to ejecting knowledge as a mechanism by which to understand others (stage 3). But Baldwin also views these stages as something like circular processes, that go on, in effect, simultaneously. In other words, in the projective process the child in effect says, What others are, I must be. In the ejective process, the child in effect says, What I am, others must be. Between both, the subjective serves a transformative function in what Baldwin calls generally the dialectic of personal growth. Without worrying about further specificity of these stages, the point here is that Baldwin, to the extent he is successful, gets it both ways: a means to understand and chart ontogenesis and microgenesis.

Baldwin builds on this view when he analyzes the relationship between egoism and altruism. Consider a situation where a man spends every weekend helping his elderly and cranky aunt, and in the process forgoes his pleasureful weekend activities. His actions appear altruistic. But let us say that the aunt is quite wealthy, and that the person says that the only reason he helps his aunt is because he hopes to inherit millions of dollars when the old lady finally dies. Given such a reason, the act now appears selfish. It is nothing new of course to say that an agent's reasons are needed to assess the moral quality of an act. It is this point that distinguishes, for example, behavioristic approaches to studying moral development from those that are cognitive, that take seriously the development of reasoning and thought. But, even with this framing, it sets up an "either/or" analysis. Either the person is helping his elderly aunt altruistically, out of a benevolent desire to help a person in need; or he is helping for the purely selfish reason that he hopes to inherit a lot of money (or to promote the survival of his genes, or any other "selfish" reason that one might want to substitute).

In Baldwin's view, from a psychological standpoint such a situation is framed wrongly. For, according to Baldwin, egoism and altruism are fundamentally linked.

> The ego and the alter are thus born together. Both are crude and unreflective, largely organic. And the two get purified and clarified together by this twofold reaction between project and subject, and between subject and eject. My sense of myself grows by imitation of you, and my sense of yourself grows in terms of my sense of myself. Both ego and alter are thus essentially social. (p. 9)

That is, from the start, a child is neither entirely selfish nor entirely altruistic: both go together, because both depend on one another in the child's development. It is part of the very dialectic (the back and forth movement) between self and other that is part of the projective and ejective processes. Thus Baldwin is attempting to reshape the very nature of the either/or question. It is not that people are either altruistic or egoistic, but both. And an analysis has to take up both constructs together.

Let us now move back to the biophilia construct. Building on both Kohlberg and Baldwin, I suggest that structural-developmental theory can offer an alternative perspective on what sociobiologists call "the problem of altruism." Instead of trying to reduce altruism to selfishness ("the selfish gene"), both are accounted for but in an hierarchically integrated sense. As the "self" expands to include not only one's brother or family, but friends, community, nation, and world, the "self" is not lost, but embedded in a larger "alter." Indeed, in specific circumstances, the self can still assert itself in "individualistic" ways. For example, when being attacked by a rapist, a woman may well lash out with fury and fight. Such "self-oriented" action need not be interpreted as a "regression," but the assertion of self in a context-specific situation. Thus, in terms of structural-developmental theory selfishness does not disappear, but gets transformed into a more complex and adequate -- and qualitatively different type of -- ethical understanding. Similarly, from a structural-developmental perspective, it is possible that "biophobia" undergoes qualitative changes in development, and becomes increasingly subsumed and integrated within a biophilic orientation.

To convey some sense of what such an biophilic integration might look like, here are three brief, highly speculative developmental characterizations.

Level I: Fear and dislike of nature. Nature (e.g., an animal or forest) represents a physical and psychological threat to the self. Nature is viewed as an unknown, dangerous, foreboding. Snakes and spiders especially are shunned or killed (cf. Kellert's 1985 characterization of the negativistic attitude toward nature).

Level II: Dominating affiliation over nature. Nature is still recognized as a potential threat, but a creative spirit begins to affiliate with nature in the context of a mastery over it. The following story might represent an example. Some time ago I walked into a cafe in a rural logging town in Northern California, and found myself enchanted by all the photographs on the wall. Pictures of old-time loggers, trees being cut, thousands of logs floating down a wild river; huge trees – 8 feet in diameter -- felled, with the loggers on top of them (drinking their equivalent of a Budweiser). Apparently many people, back then and now, find these pictures aesthetically pleasing. After all, the owners of the cafe hung the pictures with the hope of creating an inviting atmosphere for patrons of their restaurant. The pictures presumably intimate an affiliation with nature that comes from using it, creatively, even aggressively. In this way, "biophobia" still exists, but is potentially embedded within a biophilic structure.

Level III: Integrated affiliation with nature. The threats of nature remain, as does an enjoyment of dominating it, but both are integrated into a larger ecological context in which humans themselves move and have their being. Along this line, Nelson (1989) writes of the following experience after killing a deer in his homeland in Alaska:

> I whisper thanks to the animal, hoping I might be worthy of it, worthy of carrying on the life it has given, worthy of sharing in the larger life of which the deer and I are a part. Incompatible emotions clash inside me -- elation and remorse, excitement and sorrow, gratitude and shame. It's always this way: the sudden encounter with death, the shock that overrides the cushioning of the intellect. I force away the sadness and remember that death is the spark that keeps life itself aflame. (p. 263)

Nelson notes his feelings of "elation" and "excitement" in the kill, in the domination over nature, except it is no longer domination but an affiliation with nature that weaves his own life into that which he has killed: "worthy of sharing in the larger life of which the deer and I are a part".

Whether these characterizations actually correspond to developmental changes, psychologically, is not the point. I suggest them only illustratively to convey some sense of how one can begin to think about biophilia from a structural-developmental perspective, and of what becomes possible in terms of a research program.

Section V. Data that Supports a Structural-Developmental Account of Biophilia.

Colleagues and I have recently conducted three structural-development studies that bear on the biophilia hypothesis. In Study 1 (Kahn & Friedman, in press), 72 African-American children (across grades 1, 3, and 5) were interviewed from an economically impoverished urban community in Houston, Texas on their conceptions and values toward nature. In Study 2 (Kahn & Friedman, in preparation), 60 children of mixed ethnicity (across grades 2, 5, and 8) were interviewed on their views and values about an ecologically harmful event, an oil spill. In Study 3 (Howe, Kahn, & Friedman, in preparation) we modified the methods from the first study and interviewed in Portuguese 44 fifth-grade Brazilian children who lived along the Rio Negro in either the city of Manaus (the capital of the state of Amazonas) or a small remote village a day's journey up river.

Foremost, our results from Study 1 suggest that the serious constraints of living in an economically impoverished urban community cannot easily squelch these children's diverse and rich appreciation for nature, and moral responsiveness to its preservation. For example, 96% of the children said that they thought about nature, and then mentioned animals (59%), plants or trees (54%), various types of pollution (20%), and garbage (20%). Eighty-four percent of the children said that animals were

an important part of their life, 87% for plants, and 70% for parks. Children's interest in nature also extended into aspects of their family life and activities. For example, 72% of the children said that they talk about the environment with family members. Children reported on conversations with their family that included litter or garbage (47%), air pollution (25%), plants (23%), water pollution (17%), and animals (13%). Roughly half of the children (57%) have themselves started such conversations.

Assessments were also made of children's judgments of throwing garbage in a bayou in six different conditions. Three conditions focused on the magnitude of harm. Consider, for example, that one person camping in a wilderness area causes virtually no environmental harm; millions of people in the same area do, as the environmental degradation of many national parks in the United States attest to. Thus of the first three conditions, two involved negligible environmental harm: of a single person who throws garbage in a bayou in the child's own cultural context, and in a context that legitimates the practice. The third condition involved more substantial harm: of an entire community that routinely throws its garbage in a bayou. Results showed that virtually all of the children judged these acts to be wrong (96%, 96%, and 94%, respectively).

The remaining three conditions focused on children's proximity to harm. Across a diverse range of literature, including studies on obedience to authority (Milgram 1974), conceptions of genetic engineering and nuclear power (Fleming, 1984), and conceptions of computer property and privacy (Friedman, 1988), research shows that the more remote an individual from the resulting harm, the more likely is the individual to cause or permit that harm to occur. A similar environmental finding often appears in the popular press. People seem to object to environmentally degrading acts more often when those acts occur close to their homes than in other parts of their country or globe. Correspondingly, a common popular expression has arisen – NIMBY (Not In My Back Yard). Thus the final three of the six conditions examined judgments about throwing garbage in a bayou in a distant geographical location. Paralleling the first three conditions, the fourth and fifth conditions involved a single individual who throws garbage in a bayou. The sixth condition involved an entire community that routinely throws its garbage in the bayou. Results also showed that virtually all of the children judged these acts to be wrong (96%, 87%, and 91%, respectively).

By design, assessments based on these six conditions played a dual role, and informed on whether children conceived of throwing garbage in the bayou as a violation of a moral obligation. Drawing on the moral philosophical literature (e.g., Gewirth, 1978; Rawls, 1971) and moral-developmental literature (e.g., Kahn, 1991, 1992; Nucci, 1981; Smetana, 1983; Turiel, 1983), a moral obligatory judgment is prescriptive, independent of local cultural practices and laws, and generalizable to other people and cultures with different practices and laws. Based on these criteria, 87% of the children viewed polluting a bayou as a violation of a moral obligation. Moreover, the large majority of children believed that throwing garbage in a local bayou would cause harmful effects to birds (94%), water (95%), insects (80%), local people (91%), and the view (92%). In addition, children said that it would matter to them if such harm occurred to birds (89%), water (91%), insects (77%), local people (83%), and the view (93%).

From these quantitative results, our study shows specific ways in which these children (1) were aware of environmental problems, (2) discussed environmental issues with their family, (3) valued aspects of nature, and (4) acted to help the environment. Moreover, these children brought to bear judgments of moral obligation on certain acts of polluting.

As noted earlier, Wilson (1984) suggests that one excellent way to investigate biophilia is through studying the landscapes that wealthy individuals inhabit when free from their work (e.g., where they go to vacation, where they build summer residences, and so forth). His reasoning is that people who are largely free from economic and time constraints would most exhibit "natural" --

genetically-based -- inclinations, and inhabit landscapes that from an evolutionary standpoint contribute to survival and reproductive success (e.g., water access, bluff tops, and savanna-like landscapes). It also seems the case, however, that further support for biophilia could come by studying people who are not wealthy but, on the contrary, extremely poor and living in an inner-city. For if an affiliation with nature can be shown to exist even in those people most encumbered by economic and urban constraints, then that would speak to pervasive and deeply-abiding biophilic characteristics. Our findings from children in urban poverty provide such initial support.

Our findings can be further understood within a structural-developmental framework. In its broadest characterization, two forms of environmental reasoning emerged from all three studies: homocentric and biocentric. Homocentric reasoning focused on the interests of humans to justify protecting the environment, and included appeals to personal interests, aesthetics, and the physical welfare of humans. For example, consider the following justifications children provided about why it is wrong to pollute a waterway:

> [It's not alright to pollute the bayou] because if it's dirty I might get sick.
>
> [It's not alright] because some people that don't have homes, they go and drink out of the rivers and stuff and they could die because they get all of that dirt and stuff inside of their bodies.

In these responses, children say that the underlying reason why environmental degradation is wrong lies in the environment's harmful effect on human welfare: sickness and death.

A less direct form of homocentric reasoning can be seen in the aesthetic justifications. Here an appeal is made to ways in which the natural environment can render pleasure to humans in terms of its beauty.

> [It is not alright to throw trash in the local bayou because] the bayou, it should look beautiful...Because like if my relatives or something come over, I could take them to the bayou and see, and show them how beautiful it is and clean.
>
> A better one [bayou] is a cleaner one, is the best because...if you live around dirtiness then it won't look good around your house.

This reasoning appears to turn centrally on how humans appreciate the aesthetic experience of the natural environment. Thus, for example, the first child reasons that it is not alright to throw trash in the bayou because a bayou should look beautiful, and that other humans (his relatives) would also like to see a beautiful bayou.

In contrast to homocentric reasoning, biocentric reasoning highlights that the natural environment has moral standing that is at least partly independent of its value as a human commodity. For example, children occasionally argued that nature has intrinsic value, and they established that value by means of what could be called a naturalistic fallacy in its most literal form.

> Because water is what nature made; nature didn't make water to be purple and stuff like that, just one color. When you're dealing with what nature made, you need not destroy it.
>
> I think that neither one should throw their trash in the bayou because the bayou has been clear for a whole lot of years.

Both children highlight that what is ("what nature made") ought to remain ("you need not destroy it").

Thus an "ought" is derived from what "is".

A second form of biocentric reasoning focuses on rights for nature. Two ways of establishing such rights appeared. In one way, natural objects (usually animals) are compared directly with humans:

> Bears are like humans, they want to live freely...Fishes, they want to live freely, just like we live freely...They have to live in freedom, because they don't like living in an environment were there is much pollution that they die every day.

Thus an animal's desire ("to live freely") is viewed to be equivalent to that of a human's desire, and because of this direct equivalency animals merit the same moral consideration as do humans. In turn, a second way of establishing rights for nature occurs through establishing indirect compensatory relationships:

> Fishes, they don't have the same things we have. But they do the same things. They don't have noses, but they have scales to breathe, and they have mouths like we have mouths. And they have eyes like we have eyes. And they have the same co-ordinates we have....A co-ordinate is something like, if you have something different, then I'm going to have something, but it's going to be the same. Just going to be different.

Here the child struggles, quite eloquently, with the idea of a "co-ordinate" by which he seeks to explain that while animals are in some respects not the same as people (they don't have noses like people do), that in important functions (such as breathing and seeing) they are the same. In other words, this child moves beyond a reciprocity based on directly perceivable and salient characteristics to be able to establish equivalences based on functional properties.

In addition, children occasionally focused on taking care of the natural environment in some long-term, less personal, sense. Here are two responses from the same child:

> [Plants are important] because we're supposed to keep -- take care of all the plants and everything like people have plant stores and they take care of plants.

> [I care about animals because] those are animals that everyone must take care of...Because God put the animals on earth for people to, like for pet stores. To keep and take care of them.

We can note here an influence of the economically impoverished urban environment. It is not surprising that this child's understandings of the natural environment are closely tied up with such city constructs as plant stores and pet stores. Wide open farm lands and wilderness are not centrally part of his experience. But even given the constraints of the city, one can see a beginning sense of stewardship for the land – that humans are responsible for the wellbeing of plants and animals.

Developmentally, homocentric reasoning cut across the ages; in contrast, biocentric reasoning, although limited in its use, was used primarily by older children. This developmental finding is in accord with our qualitative analysis that shows ways in which biocentric reasoning comes to integrate homocentric reasoning into a more comprehensive environmental structure. For example, when children accorded rights to animals, such reasoning was not in contradiction to according rights to humans, but rather enlarged the scope of what has moral standing (e.g., "bears are like humans, they want to live freely").

It is possible that the development of an aesthetic sensibility helps foster the move from homocentrism to biocentrism. Recall that we defined aesthetic reasoning as an appeal to the preserva-

tion of the environment for the viewing or experiencing pleasure of humans. Framed in this way, it is a homocentric justification. But it also seems plausible that many biocentric concepts -- such as those that focus on the intrinsic value of nature -- depend on valuing the natural environment in some experientially aesthetic way. Minimal support for this proposition can be derived from the results from Study 1 which showed that the use of the aesthetic justification category (like the biocentric category) increased with age. Moreover, the qualitative data from Study 2 provide clear indications of how aesthetic sensibilities help structure biocentric reasoning. For example, in justifying an environmental judgment, one fifth-grade child said:

> Yea, because it looks better...Well I mean without any animals the world is like incomplete -- it's like a paper that's not finished.

Here aesthetic reasoning ("it looks better") is part of a biocentric orientation that we call "teleos of nature": an appeal to the design or purpose in natural objects, processes, or occurrences ("without any animals the world is like incomplete; it's like a paper that's not finished").

This preliminary developmental account may be fairly robust. For example, in Study 3 we interviewed in Portuguese 5th grade Brazilian children from Manaus, the capital of the State of Amazonas, and Novo Ayrao, a small remote village. Both locations border the Rio Negro, and are located roughly in the center of the Amazon region.

Both groups of Brazilian children demonstrated environmental sensitivities and commitments based on a wide range of measures. The children were aware of various environmental problems (such as air and water pollution, and the "quemada" -- that is, the burning of the Amazon jungle). They discussed environmental issues with their family. They believed that throwing garbage in the Rio Negro hurt various parts of the environment (namely, birds, insects, the view, and people who lived alongside the river), and they cared that such harm occurred. The children also demonstrated understandings of and sympathies toward the Amazon rain forest. They believed, for example, that the current logging practices employed in the jungle were wrong, and that the government, and they themselves, should do something to stop the deforestation. Results also showed that children believed that people were morally obligated not to throw garbage in the Rio Negro. Coupled with the justification data, this assessment of moral obligation drew on three measures wherein children's judgments were prescriptive, independent of local conventional practices, and generalizable to people in far off locations.

By design, many of the data from the Brazilian study were collected so that they could be directly compared to the data from Study 1 (in the United States). The results from this cross-cultural comparison showed remarkably few differences. For example, there were only two statistical differences between the groups across 26 separate questions (which formed a large body of both studies), and across the summed scored analysis that profiled children's environmental orientations. In addition, the coding system that was used to code the Brazilian children's environmental moral reasoning virtually replicated the system developed in the Houston study, and this system proved comprehensive enough for the task. Indeed, the structure of children's reasoning sometimes almost echoed one another. Consider the following four matched pairs of examples.

> 1A. [It is not all right to throw garbage in the river] because it causes pollution that is dangerous for us. Because now we have cholera, a very dangerous disease and there are others attacking us like the malaria. (Brazilian child)

> 1B. Because some people that don't have homes, they go and drink out of the rivers and stuff and they could die because they get all of that dirt and stuff inside of their bodies. (Houston

child)

Both of the above children reason that is wrong to throw garbage in the local waterway because people might drink from polluted water, and get sick ("now we have cholera, a very dangerous disease"; "they could die").

> 2A. Because the river was not made to have trash thrown in it, because the river belongs to nature. (Brazilian child)
>
> 2B. Because water is what nature made; nature didn't make water to be purple and stuff like that, just one color. When you're dealing with what nature made, you need not destroy it. (Houston child)

Both of the above children base their environmental judgments on the view that nature has its own purposes ("the river was not made to have trash thrown in it"; "nature didn't make water to be purple and stuff").

> 3A. Because animals have to have their chance. They also must have to live. We should not mistreat them, because if it happens to us, we don't like it. (Brazilian child)
>
> 3B. Some people don't like to be dirty. And when they throw trash on the animals, they probably don't like it. So why should the water be dirty and they don't want to be dirty. (Houston child)

Both of the above children judge as wrong the mistreatment of animals based on considering whether humans would similarly like to be treated in that way ("because if it happens to us, we don't like it"; "some people don't like to be dirty...[so the animals] probably don't like it").

> 4A. Even if the animals are not human beings, for them they are the same as we are, they think like we do. (Brazilian child)
>
> 4B. Fish don't have the same things we have. But they do the same things. They don't have noses, but they have scales to breathe, and they have mouths like we have mouths. And they have eyes like we have eyes. (Houston child)

Both of the above children recognize that while animals are not identical to human beings ("animals are not human beings"; fish don't have the same things we have") that both animals and people have significant functional equivalences (animals "think like we do"; fish "don't have noses, but they have scales to breath").

One explanation for these cross-cultural similarities is that there may be inherent aspects of nature itself which help give rise to children's environmental constructions. In this respect, nature is not a mere cultural convention or artifact, but part of a reality that bounds children's cognition (Soule & Lease, 1995). This explanation is also compatible with the types of differences that were found between cultures in so far as the differences appeared to be tied closely to objective qualities of the environment. Insects in the Amazon region, for example, present more of a danger to human welfare than do insects in cities in the United States; accordingly, fewer Brazilian children than urban children in the United States showed concern for the welfare of insects.

Taken as a whole, this emerging body of research begins to support a structural-developmental account of biophilia. The research speaks to children's deeply abiding affiliation with nature, and

begins to characterize the developing structure of children's environmental thought and value. Particularly here -- by means of hierarchical integration -- the research suggests that self-oriented ways of relating to nature do not disappear in development, but become embedded in a larger ecological structure. If this account has merit, then a different way to think about the relation between biophilia and biophobia emerges. Instead of seeing the constructs as one another's counterpoint (Orr and Ulrich), or both extensively following principles of genetic fitness (Wilson), it is possible that through the individual's construction of environmental knowledge and value, biophilia increases in scope and adequacy, and in so doing transforms a biophobic orientation.

Conclusion:

Increasingly, environmental problems prose grim prospects for us, and for future generations. In this context, Wilson, Kellert, and others seem right about the need to pursue vigorously more research across many disciplines that bear on understanding nature, and of the human relation therein. Yet if biophilia is to offer a substantive basis for such inquiry, it needs to continue to extend beyond its biological underpinnings. Thus, I have moved toward providing biophilia with an ontogenetic framework. One last example can perhaps solidify its importance.

Houston, Texas is one of the most polluted cities in the United States. Local oil refineries contribute not only to the city's air pollution, but to distinct oil smells during many of the days. "Treated" sewage is often discharged into the bayous which run through the city of Houston, and by this means the sewage is transported to the ocean. The bayous often smell of pollution, and are not safe for swimming or wading. Within this context, the results with an African-American population showed that two-thirds of the children we interviewed understood about ideas of air and water pollution in general. However, only one-third of the children believed that environmental issues affected them directly. How could this be? How could children who know about pollution in general, and live in a polluted city, be unaware of their own city's pollution? A possible answer is that for children to understand the idea of pollution, they need to compare existing polluted states to those that are less polluted. In other words, if children's only experience is with a certain amount of pollution, then that amount becomes not pollution, but the norm against which more polluted states are measured. If we are right about this, then it would speak to the importance of keeping environmental preserves, refuges, and parks close to (and even within) cities, and of providing means for children to experience these areas.

Equally important, what we perceive in the children we interviewed might be the same psychological phenomenon that affects us all from generation to generation. People may take the natural environment they encounter during childhood as the norm against which to measure pollution later in their life. The crux here is that with each ensuring generation, the amount of environmental degradation increases, but each generation takes that amount as the norm -- as the non-polluted state. As an example of such "generational amnesia," consider when the following passage was written:

> This [society] is born of an emergency in conservation which admits of no delay. It consists of persons distressed by the exceedingly swift passing of wilderness in a country which recently abounded in the richest and noblest of wilderness forms, the primitive, and who purpose to do all they can to safeguard what is left of it.

It could be thought that this passage was written within the last decade, as we are indeed witnessing a swift passing of wilderness in our country. The passage was written, however, in 1935 as the opening to the first issue of the magazine for The Wilderness Society (The First Issue, 1993, p. 6). Thus, if environmental generational amnesia exists, then this psychological phenomenon would provide a

partial explanation of how our world has moved toward its environmentally precarious state. Moreover, the finding would speak to the importance that must be placed on the individual's construction of environmental knowledge and values.

It is both a surprise and concern that, to date, developmental psychologists have remained largely silent in seeking to understand the development of the human relationship with nature. A surprise, because it would seem apparent that deep and abiding environmental sensitivities and commitments form during childhood. A concern because our environmental problems, locally and globally, do not quit. On both counts, theoretical and applied, developmental psychologists have important and exciting contributions to make.

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